A MAGIC TRICK IN HONOR OF THE CLASS OF '89

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ALL DATES IN THIS CENTURY (except one) LEAD TO 1989

Teacher: Choose any year in this century that has historical significance.

Student: OK--1929, the year of the stock market crash.

Teacher: Drop the hundred's digit, 9, and arrange the remaining digits to form the largest possible three-digit number and the smallest possible three-digit number.

Student: OK--That's 921 and 129.

Teacher: Subtract the smaller from the larger.

Student: 792.

Teacher: Add this number to the number formed by reversing its digits.

Student: That's 792 + 297 = 1089.

Teacher: Put the 9 back in the hundred's place.

Student: 1989!!!!!

Teacher: As I said, all dates lead to 1989.

Here are the rules:

1) Choose any year from this century. It will of course contain the digits 1 and 9. Delete the 9 in the hundred's place.

2) Use the remaining digits to form the largest possible number and the smallest possible number.

   NOTE: You can simply use the remaining digits in the order in which they appear and subtract their reversal if you see that this would not yield a palindrome where the number and its reversal are identical, giving zero when the subtraction is performed.

3) Subtract the smaller from the larger. Be sure to treat the result as a three-digit number.

4) Add the number that results from the subtraction to its reversal.

5) Put the 9 back in the hundred's place.

Look at these examples:

1921- - - -> 211 - 112 = 099- - - -> 990 + 99 = 1089- - - -> 1989

1988- - -> 881 - 188 = 693- - - -> 693 + 396 = 1089- - - -> 1989

Student: Does this work for any year in this century?

Teacher: Try it for 1911.

Student: 1911- - - -> 111 - 111 = 0. Too bad.
Why does it work otherwise?

Teacher: I was hoping you would ask. After you delete the 9 from the chosen year, you are working with 3 digits; suppose the largest possible three-digit number is written abc. Then the smallest is cba, and except for when the chosen year is 1911, a, b, and c are not all equal, and a is definitely greater than c. In place value form the subtraction goes like this:

	hundred's	ten's	unit's
	a	b	c
−	c	b	a

Since a is greater than c, we must borrow for the subtraction in the unit's column. The subtraction sets up as follows:

	a	b–1	c+10
−	c	b	a

Now we see that it is necessary to borrow for the ten's column, since b–1 is less than b. So we have

	a–1	b–1+10	c+10
−	c	b	a
	a–1–c	b–1+10–b	c+10–a or,
	a–1–c	9	c+10–a **

Add this number to its reversal:

	a–1–c	9	c+10–1
+	c+10–1	9	a–1–c
	9	18	9

The value of 9 hundreds plus 18 tens plus 9 units is 900 + 180 + 9. So at this stage, you always have 1089 and putting the 9 back gives 1989.

Student: I noticed that when I subtracted the smallest three-digit number from the largest (Step 3), the answer always has a 9 as the middle digit.

Teacher: Yes, that shows up in **. What do you notice about the two outside digits?

$$\begin{array}{rr} 942 & 991 \\ -\ \underline{249} & -\ \underline{199} \\ 693 & 792 \end{array}$$

Student: They always add up to 9?

Teacher: Good. You are so smart. You must have a very good teacher.

Student: Do you have to begin with a year from this century?

Teacher: No. You can begin with any 4-digit number and delete one of them, or simply work with three digits to begin with. The neat thing about working with a year from this century is that it appears that the 9 deleted at the beginning is the 9 that is replaced at the end. Magicians like to keep up with appearances.

REFERENCES

Frankenstein, Marilyn. "Using Mathematical Magic to Reinforce Problem-Solving Methods". *The Mathematics Teacher*, 77 (February, 1984): 96–100.

MATH SCRAMBLER answers: FORTY EQUAL CENTER FACTOR ONE A YEAR

Solution to MATHSEARCH sample: numbered, numeral, number, group, polar, pound, round, gram, lune, real, ream. Point total, 24.